Closed-Loop Pure Oxygen Static Feed Fuel Cell for Lunar Missions, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

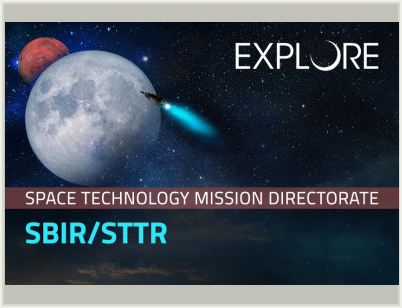
In order to address the NASA lunar mission, DESC proposes to develop a proton exchange membrane (PEM) closed-loop pure oxygen fuel cell for application to lunar surface exploration, building upon DESC's expertise and fundamental demonstrations in closely related technology. Building upon the recent NASA SBIR Phase II and Navy SBIR Phase I work, the static feed URFC hardware will be converted for primary fuel cell performance. The cell performance will be characterized with two or more membrane-electrode assembly configurations with a goal of achieving the highest efficiency. Sub-scale stacks will be tested for durability. Thermal modeling will be conducted to predict the level of heat removal required by scale-up stacks. Thermal management techniques will be investigated to permit effective scale-up.

Anticipated Benefits

In addition, DESC is working to commercialize discrete RFC (DRFC) systems for terrestrial back-up power applications. DESC's UNIGEN

REG

regenerative fuel cell is under development for telecommunications backup power systems as a replacement for valve regulated lead acid batteries and commercial generator sets. This back-up power system provides both ride-through capability and rapid response characteristics at a lower overall life cycle cost than conventional technology. A natural extension of back-up power is application in conjunction with inherently intermittent renewable energy sources. Additional massive undeveloped markets are emerging as the two billion inhabitants of the planet now without electricity move toward access to power. Small-scale power generation and/or storage will become another distributed technology analogous to cell phones for communications. Based on DESC's unique experience in commercializing PEM-based products, transitioning to military and civilian aerospace applications are important outcomes of this technology development effort. Civilian commercial derivatives of this technology would be enabling technology for airship-based telecommunications systems and reliable remote power applications. Impacts of this technology on military operations include enabling high altitude unmanned aerial vehicle operations and a variety of underwater vehicle operations, especially unmanned underwater vehicles. The similarity between the high altitude and undersea applications is that both require the storage of oxidant in addition to the storage of fuel. Pure oxygen capable fuel cells are a critical need for both operating environments. The high altitude UAV's can be used for missile defense, surveillance and communications. Undersea applications include long-term distributed data gathering with long endurance buoys, transport of special forces personnel, and mine neutralization among others.



Closed-Loop Pure Oxygen Static Feed Fuel Cell for Lunar Missions, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

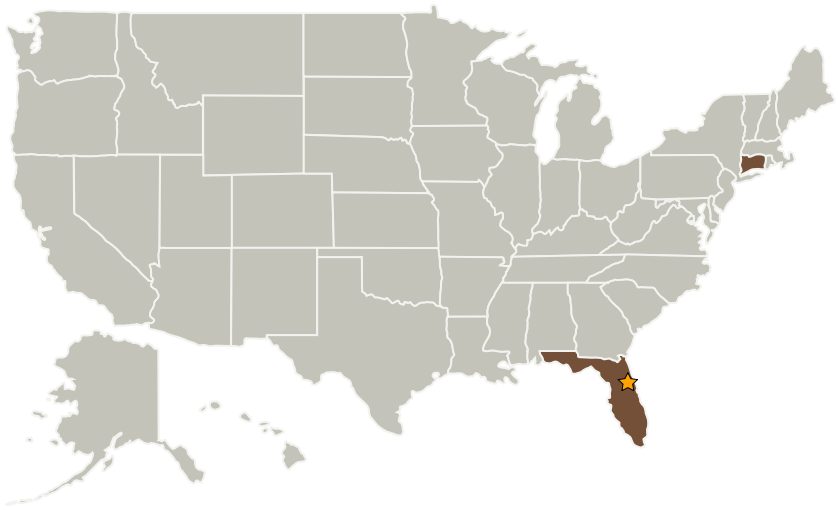
Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Closed-Loop Pure Oxygen Static Feed Fuel Cell for Lunar Missions, Phase I

Completed Technology Project (2007 - 2007)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
Proton Energy Systems, Inc.	Supporting Organization	Industry	Wallingford, Connecticut

Primary U.S. Work Locations	
Connecticut	Florida

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
William W Mcquade

Principal Investigator:
Luke Dalton

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.2 Electrochemical: Fuel Cells